

IN THE CLAIMS

Please amend the claims as follows:

Claim 1 (Currently Amended): A method of recognizing a document image including a plurality of areas, comprising ~~the steps of~~:

- a) inputting said document image as a digital image;
  - b) specifying a background color of said document image;
  - c) extracting a plurality of pixels located in areas other than a background area from said document image by use of said background color;
  - d) creating a plurality of connected elements by combining said plurality of pixels;
- and
- e) classifying said plurality of connected elements into a plurality of fixed types of areas by using at least features of shapes of said plurality of connected elements to obtain an area-separated document image;
  - f) creating a binary image by binarizing said area-separated document image;
  - g) classifying a plurality of areas included in said binary image into said plurality of fixed types of areas;
  - h) comparing a result of the classifying (e) and a result of the classify (g);
  - i) correcting said area-separated document image if said result of the classifying (e) is not equal to said result of the classifying (g); and
  - j) recognizing a character in a text area of said area-separated document image.

Claim 2 (Canceled).

Claim 3 (Currently Amended): The method as claimed in claim 1, wherein said ~~step~~ specifying (b) includes ~~the steps of~~:

k) clustering a plurality of colors on said document image; and  
l) setting a representative color of a largest cluster obtained by the ~~step~~ clustering (k) to said background color.

Claim 4 (Currently Amended): The method as claimed in claim 3, wherein said ~~step~~ clustering (k) includes ~~the step of~~:  
sampling each of the plurality of pixels at regular intervals; and  
clustering the plurality of colors on said document image by use of a plurality of pixel values obtained by smoothing pixels surrounding said each of the plurality of pixels.

Claim 5 (Currently Amended): The method as claimed in claim 1, further comprising ~~the step of~~ reducing a size of said document image, wherein said ~~step of~~ reducing the size of said document image includes ~~the steps of~~:  
~~diving~~ dividing said document image into a plurality of blocks;  
obtaining a representative color of each of said plurality of blocks;  
determining colors of said plurality of blocks after sizes of said plurality of blocks are reduced, by comparing said representative color and said background color; and  
reducing said plurality of blocks into the plurality of pixels having said colors.

Claim 6 (Original): The method as claimed in claim 5, wherein said each of the plurality of blocks is a 3x3 or 4x4 grating.

Claim 7 (Currently Amended): The method as claimed in claim 1, wherein said ~~step~~ extracting (c) includes ~~the step of~~ determining a focused pixel as a pixel located in an area

other than said background area if a difference between three primary colors of said background color and said focused pixel is larger than a fixed value.

Claim 8 (Currently Amended): The method as claimed in claim 1, further comprising ~~the steps of:~~

creating the document image, in which a figure or photograph rectangular area separated by said ~~step~~ classifying (e) is painted over with a specified color;

binarizing said document image; and

recognizing characters on a binary image obtained by binarizing said document image.

Claim 9 (Currently Amended): The method as claimed in claim 1, further comprising ~~the step of~~ recursively performing said ~~step~~ classifying (e) to a specific rectangular area classified at said ~~step~~ classifying (e).

Claim 10 (Currently Amended): A method of recognizing a document image, comprising ~~the steps of:~~

- a) inputting said document image as a digital image;
- b) performing color area separation to said document image;
- c) creating a binary image for each area separated by said color area separation;
- d) creating a single binary image by combining said binary image for each area, thereby performing binarization to said document image;
- e) performing binary area separation to said single binary image;
- f) comparing a result of said color area separation and a result of said binary area separation; and

g) obtaining a binary image and a result of area separation by performing a feedback process until a certain condition is satisfied, or for a fixed number of times, in accordance with a result of the ~~step~~ comparing (f).

Claim 11 (Currently Amended): The method as claimed in claim 10, wherein said feedback process is performed in a case in which the certain condition is not satisfied in a range of said document image as the result of the ~~step~~ comparing (f), said feedback process including ~~the steps of~~:

creating an area that includes said range;  
performing said color area separation, said binarization and said binary area separation to said area; and  
performing said ~~step~~ comparing (f).

Claim 12 (Currently Amended): The method as claimed in claim 10, wherein said feedback process is performed in a case in which a text line is extracted from a range in said document image by one of said color area separation and said binary area separation, and a character rectangle including characters is not extracted from said range by the other, said feedback process including ~~the steps of~~:

specifying a character color of said character rectangle;  
determining that said range includes a character if said character color is even throughout said range;  
performing said color area separation, said binarization, said binary area separation to said range by use of said character color; and  
performing said ~~step~~ comparing (f).

Claim 13 (Currently Amended): The method as claimed in claim 12, wherein said feedback process includes ~~the steps of~~:

creating an area including the text line in a case in which said text line extracted from the range by said color area separation does not exist in the result of the binary area separation as the result of said ~~step~~ comparing (f);

performing said binarization and said binary area separation to said area; and

performing said ~~step~~ comparing (f).

Claim 14 (Currently Amended): The method as claimed in claim 10, wherein said feedback process is performed in a case in which layout features of a fixed number or more than the fixed number of text lines are continuously different between said result of the color area separation and said result of the binary area separation as the result of said ~~step~~ comparing (f), said feedback process including ~~the steps of~~:

creating an area including said text lines;

binarizing said area;

performing said binary area separation to said area; and

performing said ~~step~~ comparing (f).

Claim 15 (Original): The method as claimed in claim 10, wherein an image-division-type binarizing method is applied to a text area of said document image, and a discriminant analysis method is applied to ruled-line, figure, and photograph areas.

Claim 16 (Currently Amended): The method as claimed in claim 10, wherein said color area separation includes ~~the steps of~~:

specifying a background color of said document image;

extracting a plurality of pixels located outside a background area from said document image by use of said background color;

creating a plurality of connected elements by combining said plurality of pixels; and  
classifying said plurality of connected elements into a plurality of fixed types of areas by use of at least features of shapes of said connected elements to obtain an area-separated document image.

Claim 17 (Currently Amended): A document-image recognition device recognizing a document image including a plurality of areas, comprising:

an input unit inputting said document image as a digital image;  
a background-color specifying unit specifying a background color of said document image;

an extracting unit extracting a plurality of pixels located outside a background area from said document image by use of said background color;

a creating unit creating a plurality of connected elements by combining said plurality of pixels; and

a classifying unit classifying said plurality of connected elements into a plurality of fixed types of areas by use of at least features of shapes of said connected elements to obtain an area-separated document image;

a binary-image creating unit creating a binary image by binarizing said area-separated document image;

a correcting unit classifying a plurality of areas included in said binary image into said plurality of fixed types of areas, and correcting said area-separated document image by comparing said area-separated document image with a result of classifying the plurality of areas; and

a recognizing unit recognizing a character in a text area of said document image.

Claim 18 (Canceled).

Claim 19 (Original): The document-image recognition device as claimed in claim 17, wherein said background-color specifying unit includes:

a clustering unit clustering a plurality of colors on said document image; and  
a setting unit setting a representative color of a largest cluster obtained by clustering said plurality of colors on said document image to said background color.

Claim 20 (Original): The document-image recognition device as claimed in claim 19, wherein said clustering unit includes:

a sampling unit sampling the plurality of pixels at regular intervals; and  
a cluster unit clustering the plurality of colors on said document image by use of a plurality of pixel values obtained by smoothing pixels surrounding said plurality of pixels.

Claim 21 (Original): The document-image recognition device as claimed in claim 17, further comprising a reducing unit reducing a size of said document image, wherein said reducing unit includes:

a dividing unit dividing said document image into a plurality of blocks;  
a representative-color obtaining unit obtaining a representative color of each of said plurality of blocks;

a color determining unit determining colors of said plurality of blocks after sizes of said plurality of blocks are reduced, by comparing said representative color and said background color; and

a block reducing unit reducing said plurality of blocks into the plurality of pixels having said colors.

Claim 22 (Original): The document-image recognition device as claimed in claim 21, wherein each of said plurality of blocks is a 3x3 or 4x4 grating.

Claim 23 (Original): The document-image recognition device as claimed in claim 17, wherein said extracting unit includes a pixel determining unit determining a focused pixel as a pixel located outside said background area if a difference between three primary colors of said background color and said focused pixel is larger than a fixed value.

Claim 24 (Original): The document-image recognition device as claimed in claim 17, further comprising:

a document-image creating unit creating the document image, in which a figure or photograph rectangular area separated by said classifying unit is painted over with a specified color;

a binarizing unit binarizing said document image; and

a character recognizing unit recognizing characters on a binary image obtained by binarizing said document image.

Claim 25 (Original): The document-image recognition device as claimed in claim 17, recursively carrying out a process performed by said classifying unit to a specific rectangular area classified by said classifying unit.



Claim 26 (Currently Amended): A document-image recognition device recognizing a document image, comprising:

- an input unit inputting said document image as a digital image;
- a color area separation unit performing color area separation to said document image;
- a binary-image creating unit creating a binary image for each area separated by said color area separation;
- a binary area separation unit creating a single binary image by combining said binary image for each area, thereby performing binarization to said document image, and performing binary area separation to said single binary image;
- a comparing unit comparing a result of said color area separation and a result of said binary area separation; and
- an obtaining unit obtaining a binary image and a result of area separation by performing a feedback process until a certain condition is satisfied, or for a fixed number of times, in accordance with a result of comparison carried out by said comparing unit.

Claim 27 (Currently Amended): The document-image recognition device as claimed in claim 26, wherein said feedback process is performed in a case in which a text line is extracted from a range in said document image by one of said color area separation and said binary area separation, and a character rectangle including characters is not extracted from said range by the other, said feedback process including ~~the steps of~~:

- specifying a character color of said character rectangle;
- determining that said range includes a character if said character color is even throughout said range;
- performing said color area separation, said binarization, said binary area separation to said range by use of said character color; and

performing said comparison.

Claim 28 (Currently Amended): The document-image recognition device as claimed in claim 27, wherein said feedback process includes ~~the steps of~~:

creating an area including the text line in a case in which said text line extracted from the range by said color area separation does not exist in the result of the binary area separation as the result of said comparison;

performing said binarization and said binary area separation to said area; and  
performing said comparison.

Claim 29 (Currently Amended): The document-image recognition device as claimed in claim 26, wherein said feedback process is performed in a case in which layout features of a fixed number or more than the fixed number of text lines are continuously different between said result of the color area separation and said result of the binary area separation as the result of said comparison, said feedback process including ~~the steps of~~:

creating an area including said text lines;  
binarizing said area;  
performing said binary area separation to said area; and  
performing said comparison.

Claim 30 (Currently Amended): A record medium readable by a computer, tangibly embodying a program of instructions executable by the computer to carry out a document-image recognition process, said instructions comprising ~~the steps of~~:

- a) inputting said document image as a digital image;
- b) specifying a background color of said document image;

c) extracting a plurality of pixels located outside a background area from said document image by use of said background color;

d) creating a plurality of connected elements by combining said plurality of pixels;  
and

e) classifying said plurality of connected elements into a plurality of fixed types of areas by use of at least features of shapes of said connected elements to obtain an area-separated document image;

f) creating a binary image by binarizing said area-separated document image;

g) classifying a plurality of areas included in said binary image into said plurality of fixed types of areas;

h) comparing a result of the classifying (e) and a result of the classifying (g);

(i) correcting said area-separated document image if said result of the classifying (e) is not equal to said result of the classifying (g); and

j) recognizing a character in a text area of said area-separated document image.

Claim 31 (Canceled).

Claim 32 (Currently Amended): A record medium readable by a computer, tangibly embodying a program of instructions executable by the computer to carry out a document-image recognition process, said instructions comprising ~~the steps of~~:

- a) inputting said document image as a digital image;
  - b) performing color area separation to said document image;
  - c) creating a binary image for each area separated by said color area separation;
  - d) creating a single binary image by combining said binary image for each area,
- thereby performing binarization to said document image;

- e) performing binary area separation to said single binary image;
- f) comparing a result of said color area separation and a result of said binary area separation; and
- g) obtaining a binary image and a result of area separation by performing a feedback process until a certain condition is satisfied, or for a fixed times, in accordance with a result of the ~~step~~ comparing (f).